



# CHANGZHOU XINZHANJIANG SPECIAL FIBER CO LTD

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## Accelerated Weathering Testing Report for PET Outdoor Fabrics

2012-01-20

### 1. BACKGROUND

Just like erosion of rocks, natural phenomena can cause degradation in polymer systems. The elements of most concern to polymers are ultraviolet radiation, moisture and humidity, high temperatures and temperature fluctuations. Polymers are used in every day's life, so it is important for scientists and plastic producers to understand durability and expected lifespan of polymer products.

Weather testing of polymers is the controlled polymer degradation under laboratory or natural conditions. The artificial lab weathering process can be greatly accelerated through the use of specially designed weathering chambers. While this speeds up the time needed to get results, the conditions are not always representative of real world conditions.

Xenon Arc radiation is often used to simulate / accelerate the effect of sunlight. The ISO 4892-2 is the standard commonly adopted by XZJ and the industry. The use of these test apparatus are intended to induce property and color changes associated the end use conditions, including the effects of sunlight, moisture, and heat. These exposures may include a means to introduce moisture to the test specimen. Exposures are not intended to simulate the deterioration caused by localized weather phenomena, such as atmospheric pollution, biological attack, and saltwater exposure. Alternatively, the exposure may simulate the effects of sunlight through window glass. Typically, these exposures would include moisture in the form of humidity.

### 2. OBJECTIVE

This accelerated weathering test is a laboratory simulation of the damaging forces of weather for the purposes of predicting the relative durability of polyester fabrics exposed to outdoor environments made with customer base resin and XZJ masterbatch.

### 3. TEST RESULTS

#### 3.1. SAMPLES

Sample #	Description
#1	XZJ 13028-Z1-401 Navy – Premium
#2	XZJ 13028-Z2-401 Navy - Regular
#3	XZJ 13028-Z3-401 Navy - Economic
#4	XZJ 13028-Z5-401 Navy – Low Cost
#5	China Navy
#6	Taiwan Navy

#### 3.2. TEST METHODS

3.2.1. ISO 4892-2:2006 Plastic Test Standard: Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps

- ISO 4892-2:2006 specifies methods for exposing specimens to xenon-arc light in the presence of moisture

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to reproduce the weathering effects that occur when materials are exposed in actual end-use environments in daylight or daylight filtered through window glass.

- The specimens are exposed to filtered xenon-arc light under controlled conditions (temperature, humidity and/or wetting). Various types of xenon-arc light source and various filter combinations may be used to meet different requirements.

- ISO 4892-2:2006 Xenon Arc Test Conditions:

Test Device	Xenotest Beta LM
Irradiance	60 W/m <sup>2</sup> (300 to 400 nm)
Filter System	Xenochrome 300
Black Standard Temperature	65 °C
Chamber Temperature	43 °C
Relative Humidity	50%
Light/dark cycle	Continuous UV
UV / Spray cycles	Continuous UV / 18 minute specimen spray every two hours

3.2.2. Color Reading: CIEUnits, Illuminant D65, 10°Observer. Spectrophotometer: MacBeth Color Eye 7000

### 3.3. RESULTS/DATA

#### Sample #1 XZJ Navy – Premium 13028-Z1-401

		L*	a*	b*	DL*	Da*	Db*	CMCDE	DE
ISO-4892-2	initial	29.70	0.45	-13.61					
ISO 4892-2	250 Hrs	30.44	0.39	-14.23	0.74	-0.06	-0.62	0.65	0.97
ISO 4892-2	500 Hrs	29.86	0.52	-14.06	0.16	0.07	-0.46	0.36	0.49
ISO 4892-2	742 Hrs	30.68	0.47	-13.80	0.98	0.02	-0.20	0.63	1.00
ISO 4892-2	828 Hrs	30.31	0.52	-13.62	0.61	0.06	-0.01	0.39	0.61
ISO 4892-2	1000 Hrs	30.56	0.50	-13.70	0.86	0.05	-0.10	0.55	0.87
ISO 4892-2	1248 Hrs	30.73	0.58	-13.58	1.03	0.12	0.03	0.67	1.04
ISO 4892-2	1507 Hrs	30.75	0.71	-13.66	1.05	0.26	-0.05	0.73	1.08
ISO 4892-2	1633 Hrs	30.75	0.72	-13.70	1.05	0.26	-0.10	0.73	1.09
ISO 4892-2	1750 Hrs	30.80	0.74	-13.84	1.12	0.28	-0.24	0.80	1.18
ISO 4892-2	2000 Hrs	30.70	0.72	-14.09	1.04	0.27	-0.48	0.80	1.18

#### Sample #2 XZJ Navy – Regular 13028-Z2-401

		L*	a*	b*	DL*	Da*	Db*	CMCDE	DE
ISO-4892-2	initial	28.45	1.01	-13.44					
ISO 4892-2	250 Hrs	28.68	1.06	-14.15	0.23	0.04	-0.71	0.54	0.75
ISO 4892-2	500 Hrs	29.19	1.04	-13.94	0.75	0.03	-0.50	0.60	0.90
ISO 4892-2	742 Hrs	29.52	1.04	-13.62	1.08	0.03	-0.18	0.71	1.09
ISO 4892-2	828 Hrs	29.43	1.04	-13.47	0.98	0.03	-0.03	0.63	0.98

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ISO 4892-2	1000 Hrs	29.57	1.07	-13.53	1.13	0.06	-0.09	0.73	1.13
ISO 4892-2	1248 Hrs	29.76	1.10	-13.36	1.31	0.09	0.09	0.85	1.32
ISO 4892-2	1507 Hrs	29.40	1.18	-13.90	0.95	0.17	-0.46	0.72	1.07
ISO 4892-2	1633 Hrs	29.29	1.14	-13.98	0.84	0.12	-0.54	0.68	1.00
ISO 4892-2	1750 Hrs	29.60	1.14	-14.12	1.16	0.13	-0.68	0.90	1.35
ISO 4892-2	2000 Hrs	29.70	1.12	-14.40	1.20	0.11	-0.96	1.05	1.54

## Sample #3 XZJ Navy – Economic 13028-Z3-401

		L*	a*	b*	DL*	Da*	Db*	CMCDE	DE
ISO-4892-2	initial	27.98	0.85	-13.77					
ISO 4892-2	250 Hrs	29.05	0.92	-14.20	1.07	0.08	-0.43	0.77	1.16
ISO 4892-2	500 Hrs	28.45	1.10	-14.03	0.47	0.26	-0.26	0.47	0.60
ISO 4892-2	742 Hrs	29.03	1.07	-13.99	1.05	0.22	-0.22	0.74	1.09
ISO 4892-2	828 Hrs	29.06	1.09	-13.88	1.08	0.24	-0.11	0.76	1.11
ISO 4892-2	1000 Hrs	29.13	1.03	-13.85	1.15	0.18	-0.08	0.78	1.17
ISO 4892-2	1248 Hrs	29.37	1.08	-13.73	1.39	0.23	0.04	0.95	1.41
ISO 4892-2	1507 Hrs	28.94	1.18	-14.22	0.96	0.33	-0.46	0.80	1.11
ISO 4892-2	1633 Hrs	28.86	1.14	-14.32	0.88	0.29	-0.55	0.77	1.08
ISO 4892-2	1750 Hrs	29.20	1.18	-14.55	1.17	0.34	-0.78	1.02	1.45
ISO 4892-2	2000 Hrs	29.20	1.15	-14.97	1.20	0.31	-1.21	1.21	1.73

## Sample #4 XZJ Navy – Low Cost 13028-Z5-400

		L*	a*	b*	DL*	Da*	Db*	CMCDE	DE
ISO-4892-2	initial	29.25	0.76	-15.13					
ISO 4892-2	250 Hrs	32.13	1.06	-13.03	2.88	0.30	2.10	2.38	3.58
ISO 4892-2	500 Hrs	32.46	1.27	-12.25	3.21	0.51	2.88	2.95	4.35
ISO 4892-2	742 Hrs	33.20	1.35	-11.68	3.96	0.59	3.46	3.58	5.29
ISO 4892-2	828 Hrs	33.34	1.35	-11.47	4.10	0.59	3.66	3.74	5.53
ISO 4892-2	1000 Hrs	33.64	1.30	-11.30	4.39	0.54	3.83	3.94	5.85
ISO 4892-2	1248 Hrs	34.16	1.42	-11.15	4.91	0.66	3.99	4.28	6.36
ISO 4892-2	1507 Hrs	34.75	1.50	-11.17	5.50	0.74	3.96	4.57	6.82

Sample #4 failed and removed from testing at 1,507 hours.

## Sample #5 China Navy – Current Standard

		L*	a*	b*	DL*	Da*	Db*	CMCDE	DE
ISO-4892-2	initial	31.31	-0.43	-14.82					
ISO 4892-2	250 Hrs	32.52	-1.02	-14.92	1.21	-0.58	-0.11	0.99	1.35
ISO 4892-2	500 Hrs	33.01	-1.45	-15.13	1.70	-1.01	-0.32	1.55	2.00
ISO 4892-2	742 Hrs	33.59	-1.93	-15.35	2.29	-1.50	-0.53	2.20	2.78
ISO 4892-2	828 Hrs	33.78	-2.08	-15.39	2.47	-1.65	-0.58	2.40	3.02

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ISO 4892-2	1000 Hrs	33.93	-2.42	-15.70	2.62	-1.98	-0.89	2.78	3.41
ISO 4892-2	1248 Hrs	34.31	-2.66	-16.18	3.00	-2.23	-1.36	3.18	3.98
ISO 4892-2	1507 Hrs	34.90	-3.13	-16.96	3.59	-2.69	-2.15	3.92	4.97
ISO 4892-2	1633 Hrs	35.22	-3.45	-17.25	3.91	-3.02	-2.43	4.35	5.51
ISO 4892-2	1750 Hrs	35.50	-3.70	-17.45	4.20	-3.27	-2.63	4.68	5.93
ISO 4892-2	2000 Hrs	36.00	-4.19	-17.88	4.67	-3.76	-3.06	5.32	6.73

Sample #5 failed and removed from testing at 2,000 hours.

### Sample #6 Taiwan Navy – Old Standard

		L*	a*	b*	DL*	Da*	Db*	CMCDE	DE
ISO-4892-2	initial	27.55	0.10	-14.46					
ISO 4892-2	250 Hrs	28.59	-0.46	-14.75	1.04	-0.55	-0.30	0.96	1.22
ISO 4892-2	500 Hrs	29.11	-0.97	-14.93	1.56	-1.07	-0.47	1.63	1.94
ISO 4892-2	742 Hrs	29.73	-1.47	-15.05	2.18	-1.57	-0.60	2.34	2.75
ISO 4892-2	828 Hrs	29.94	-1.67	-15.07	2.39	-1.77	-0.61	2.60	3.03
ISO 4892-2	1000 Hrs	30.30	-2.09	-15.36	2.75	-2.18	-0.91	3.15	3.63
ISO 4892-2	1248 Hrs	30.78	-2.30	-15.68	3.23	-2.40	-1.22	3.56	4.20
ISO 4892-2	1507 Hrs	31.44	-2.68	-16.39	3.89	-2.77	-1.93	4.25	5.15
ISO 4892-2	1633 Hrs	31.76	-2.99	-16.68	4.21	-3.08	-2.22	4.68	5.67
ISO 4892-2	1750 Hrs	32.10	-3.24	-16.97	4.54	-3.34	-2.51	5.08	6.17
ISO 4892-2	2000 Hrs	32.60	-3.78	-17.49	5.04	-3.87	-3.03	5.80	7.04

Sample #6 failed and removed from testing at 2,000 hours.

#### 4. SUMMARY OF RESULTS / CONCLUSION:

After 2,000 hours of ISO 4892-2 Xenon Arc exposure, it appears that samples #4, 5 and 6 without UV protection and the most weatherable colorant systems have failed and removed from testing. The remaining specimens will be tested up to 3,000 hours.

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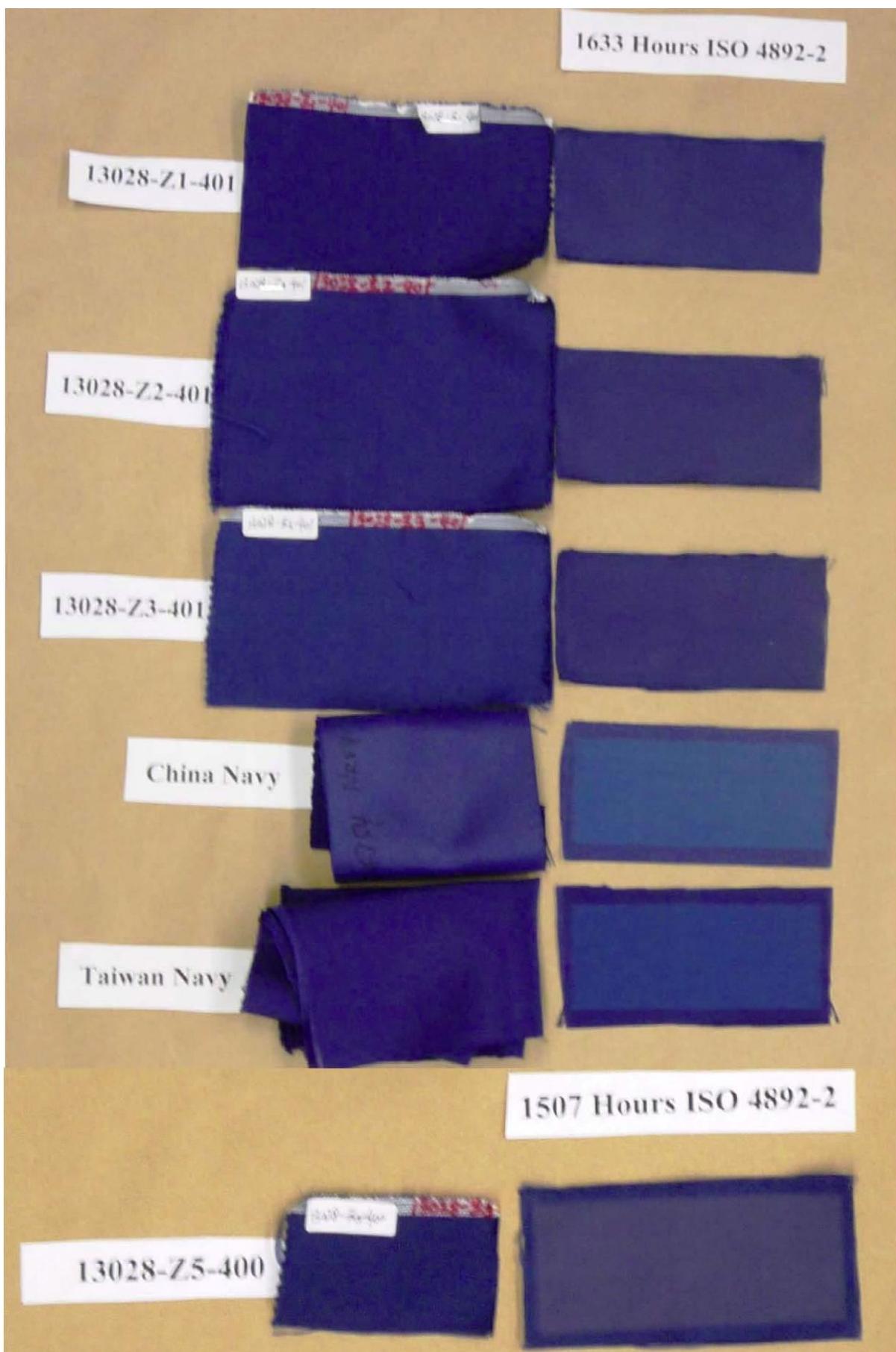


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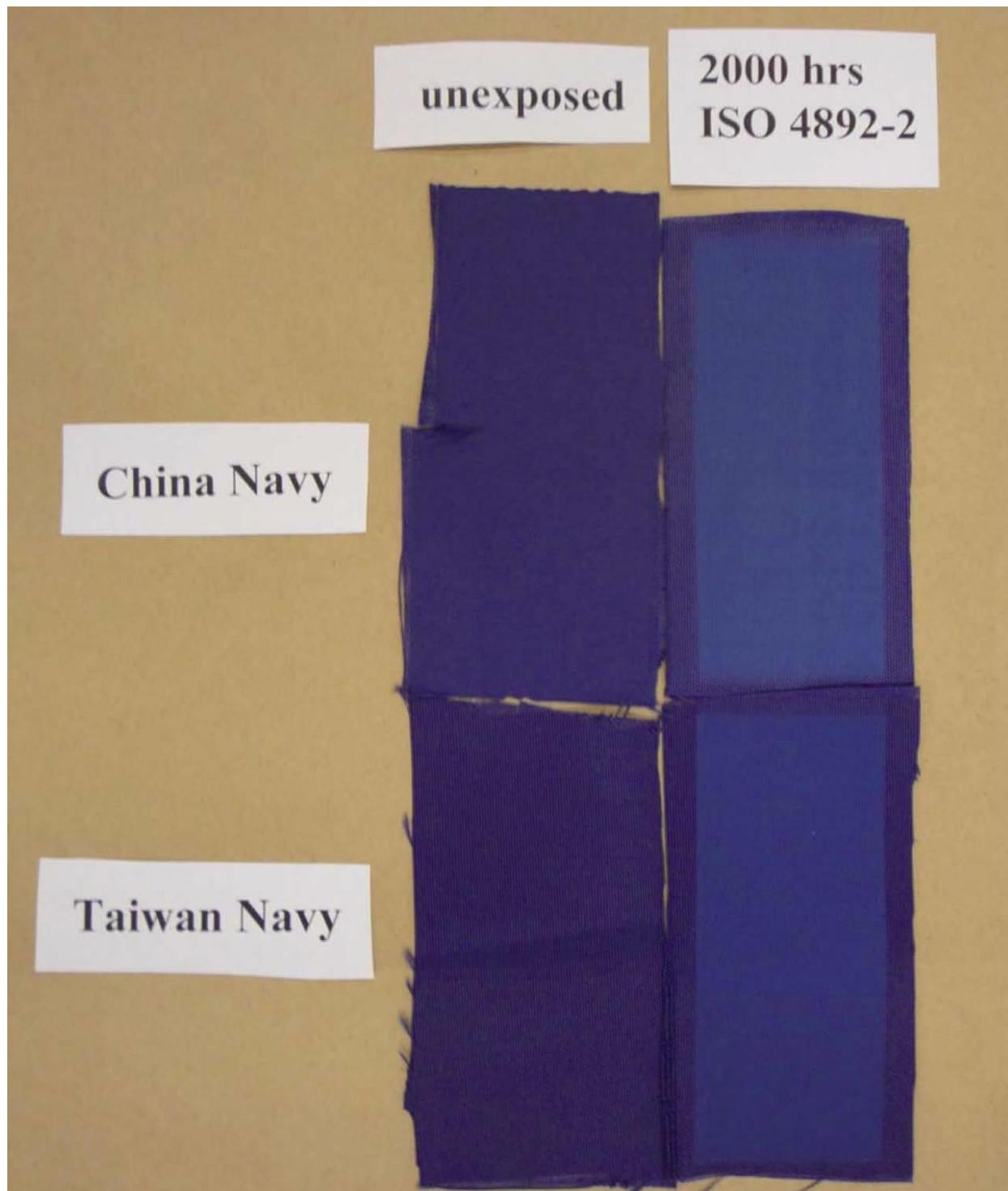


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